(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau

(43) International Publication Date
19 August 2004 (19.08.2004)

PCT

(10) International Publication Number
WO 2004/070513 A2

(51) International Patent Classification[7]: G06F

(21) International Application Number:
PCT/KR2004/000198

(22) International Filing Date: 4 February 2004 (04.02.2004)

(25) Filing Language: Korean

(26) Publication Language: English

(30) Priority Data:
10-2003-0007036 4 February 2003 (04.02.2003) KR
10-2004-0006781 2 February 2004 (02.02.2004) KR

(71) Applicant *(for all designated States except US)*: **SK TELECOM CO., LTD.** [KR/KR]; 99 Seorin-dong, Jongro-gu, Seoul 110-110 (KR).

(72) Inventors; and

(75) Inventors/Applicants *(for US only)*: **CHA, Daejoon** [KR/KR]; 202, 67-8 Bangi 2-dong, Songpa-gu, Seoul 138-829 (KR). **IHM, Jongtae** [KR/KR]; 304-502, Dongsin Apt., Imae-dong, Bundang-gu, Seongnam-si, Gyeonggi-do 463-797 (KR). **SHIN, Sungho** [KR/KR]; 103-2501, Taeyoung Apt., 660, Daeheung-dong, Mapo-gu, Seoul 121-080 (KR).

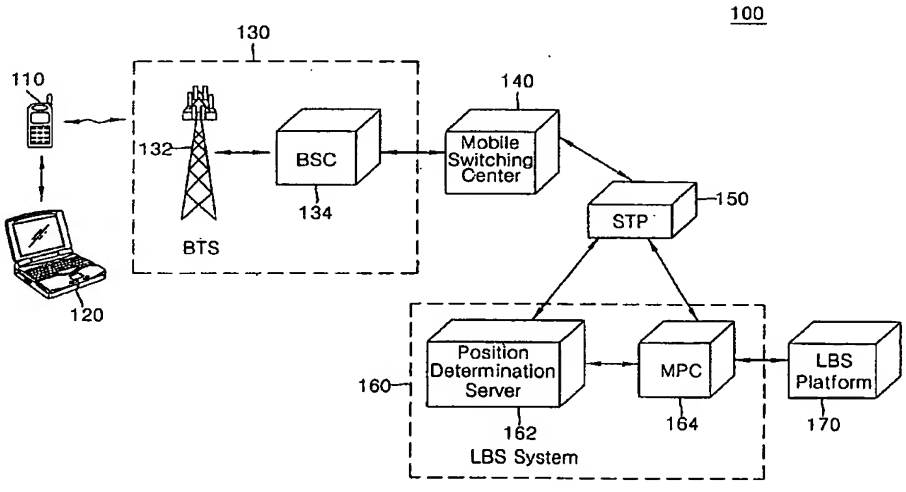
(74) Agents: **LEE, Chulhee** et al.; 14F, Hyundai Marine & Fire Insurance Bldg., 646, Yeoksam-dong, Gangnam-gu, Seoul, 135-080 (KR).

(81) Designated States *(unless otherwise indicated, for every kind of national protection available)*: AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BW, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, EG, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NA, NI, NO, NZ, OM, PG, PH, PL, PT, RO, RU, SC, SD, SE, SG, SK, SL, SY, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ, VC, VN, YU, ZA, ZM, ZW.

(84) Designated States *(unless otherwise indicated, for every kind of regional protection available)*: ARIPO (BW, GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, HU, IE, IT, LU, MC, NL, PT, RO, SE, SI, SK, TR), OAPI (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG).

[Continued on next page]

(54) Title: METHOD AND SYSTEM FOR MONITORING MOBILE COMMUNICATION TERMINAL POSITION DETERMINATION PERFORMANCE BY USING WIRELESS COMMUNICATION NETWORK AND A-GPS



(57) Abstract: Disclosed are a system, method and computer readable storage medium storing a LBS(Location Based Service) wireless network analysis program receiving, analyzing, processing and displaying LBS messages defined in IP-801-1 standard by using a wireless network and an A(Assisted)-GPS(Global Positioning System), wherein the LBS wireless network analysis program, coded in a computer language, performs analyzing the LBS messages, displays analyzed LBS messages, and processes and displays information on the wireless network, information on GPS satellite and measured coordinate values included in the LBS messages in text and/or image format.

WO 2004/070513 A2

Published:
— *without international search report and to be republished upon receipt of that report*

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4/pcts

METHOD AND SYSTEM FOR MONITORING MOBILE COMMUNICATION TERMINAL POSITION DETERMINATION PERFORMANCE BY USING WIRELESS COMMUNICATION NETWORK AND A-GPS

Field of the Invention

The present invention relates to a method and a system for monitoring performance pertinent to a position determination of a mobile communication terminal, and more particularly to a method and system for monitoring performance pertinent to position determination of a mobile communication terminal by using various parameters defined in IS(Interim Standard)-801-1 in determining position of a mobile communication terminal in wireless/mobile communication network environment using an A-GPS scheme.

Description of the Prior Art

Many companies are struggling to develop new wireless Internet technologies which can be used to provide various communication services, such as wireless Internet services, regardless of places. Wireless Internet refers to an environment or technology which allows a moving user to

access the Internet through a wireless network. With the development of mobile communication technologies and the explosive increase in the use of mobile phones, the wireless Internet services have also been greatly developed.

Among a variety of wireless Internet services provided to mobile terminals, such as cellular phones, PDAs or notebook computers, a LBS(Location Based Service) is being popularized more and more due to its wide applications and availability. The LBS can be used in various applications and conditions, such as emergency assistance, criminal tracking, GIS (Geographic Information System), difference of mobile communication fees according to locations, traffic information, vehicle navigation, logistics control and location-based CRM (Customer Relationship Management).

In order to exploit the LBS, it is required to identify the location of a mobile communication terminal. A GPS(Global Positioning System) is generally used to track the location of a mobile communication terminal.

The GPS is a worldwide navigation and positioning system which determines the location of an object on earth by using 24 GPS satellites orbiting the earth at an

elevation of approximately 20,000 km. The GPS uses radio waves in a bandwidth of 1.5 GHz. Ground control stations which monitor the GPS satellites receive information transmitted from the satellites and synchronize transmission time. Users can monitor their locations by using GPS receivers. Generally, the GPS determines the location of an object by triangulation using four satellites. Three satellites are used for accurate triangulation, and a fourth satellite is in orbit to correct a timing error.

To be more specific, in the GPS system, since position of 3 satellites are already known, a position fix is performed by measuring distance between the satellites and a GPS receiver. The distance between the satellites and the GPS receiver can be obtained by multiplying the light speed by a wave propagation time between the satellite and the GPS receiver, in which the wave propagation time can be obtained by calculating time difference between the transmission time at the satellite and the reception time at the GPS receiver equipped with an internal clock.

In the meantime, the GPS has numerous advantages that, among others, it is open to anyone in the world, there is no

constraint in the number of users, both a real-time position fix and a continuous tracking are possible and accuracy of position fix thereof is rather high enough for various applications.

However, it is difficult to determine the location of an object in downtown areas surrounded by high-rise buildings due to so-called multi-path effects and the lack of visible satellites. Also, an accurate location determination can hardly be made in a tunnel, subway or in a basement of a building where satellites are not visible (where radio waves cannot reach). In addition, GPS receivers may require a TTFF (Time To First Fix) of several minutes to over ten minutes to initially determine their location, thereby causing inconvenience to the users of location-based wireless Internet services.

A-GPS answers some of the inherent problems with GPS. The A-GPS determines the location of a mobile communication terminal by combining GPS with wireless communication network resources. A mobile communication terminal collects geolocation information from both the GPS satellites and the wireless communication network to determine its 3-dimensional location in geodetic coordinates (latitude,

longitude and altitude) with high accuracy. The wireless network and the mobile communication terminal transmit and receive data or messages containing parameters defined in IS(Interim Standard)-801-1.

Meanwhile, performance evaluation of the position determination in the position determination system for a mobile communication terminal is crucial to the communication network operator. Current performance evaluation in the A-GPS scheme, however, currently stays at the level of simply monitoring call flow messages defined in the IS-801-1 displayed on the monitor screen of a laptop computer. This bears such shortcomings that it cannot identify reasons for poor position fix performance while it only find the fact that normal position fix is suffering. In other words, the conventional position determination system cannot identify whether the poor position determination performance stems from the devices employed in the wireless communication network, from defects in the mobile communication terminal or from topography(for instance, high-rise building, mountain, trees, etc.), thereby hinders taking prompt measures thereto.

Summary of the Invention

Accordingly, the present invention has been made to solve the above-mentioned problems occurring in the prior art, and an object of the present invention is to provide a method and system for monitoring performance pertinent to position determination of a mobile communication terminal by using various parameters defined in IS(Interim Standard)-801-1 in determining position of a mobile communication terminal in wireless/mobile communication network environment using an A-GPS scheme.

In order to accomplish this object, there is provided a system for monitoring performance of a position determination of a mobile communication terminal by using a wireless network and an A(Assisted)-GPS, the system comprising: the mobile communication terminal equipped with a GPS module for picking up GPS radio wave containing a navigation data from a GPS satellite and transmitting the navigation data to the wireless network; a test device, connected to the mobile communication terminal through wired/radio link, for being loaded with and running a LBS wireless network analysis program, wherein the LBS wireless

network analysis program gathers, analyzes and processes data pertinent to the position determination and classifies processed data by at least one classification reference and displays classified data in the format of text or graph; and a position determination server for receiving the navigation data from the wireless network, converting the navigation data into longitude and latitude coordinate values, transmitting the longitude and latitude coordinate values to the mobile communication terminal and performs transmission and reception of the data pertinent to the position determination.

In accordance with another aspect of the present invention, there is provided a method for monitoring performance of position determination of a mobile communication terminal in a communication system including a mobile communication terminal picking up GPS radio wave and receiving LBS messages, a test device communicating with the mobile communication terminal and a position determination server performs transmission and reception of the LBS messages, the method comprising the steps of: (a) receiving the LBS messages on a real time basis from the mobile communication terminal; (b) analyzing received LBS messages

on a real time basis; and (c) processing analyzed LBS messages into a requested format and displaying converted LBS messages in the format of text or graph.

In accordance with yet another aspect of the present invention, there is provided a computer readable storage medium storing a LBS(Location Based Service) wireless network analysis program receiving, analyzing, processing and displaying LBS messages defined in IP-801-1 standard by using a wireless network and an A(Assisted)-GPS(Global Positioning System), wherein the LBS wireless network analysis program, coded in a computer language, performs analyzing the LBS messages, displays analyzed LBS messages, and processes and displays information on the wireless network, information on GPS satellite and measured coordinate values included in the LBS messages in text and/or image format.

Brief Description of the Drawings

The above and other objects, features and advantages of the present invention will be more apparent from the following detailed description taken in conjunction with the

accompanying drawings, in which:

FIG. 1 is a block diagram sketching a monitoring system 100 for monitoring location determination performance of an A-GPS method in accordance with the preferred embodiment of the present invention;

FIG. 2 shows the LBS messages communicated between the mobile communication terminal 110 and the position determination server 162;

FIG. 3 gives an exemplary two dimensional constellation of a multiple satellites about the true position of the mobile communication terminal 110; and

FIG. 4 is an exemplary screen displaying coordinate values of the mobile communication terminal 110 measured in accordance with the present invention about the concentric circles.

Detailed Description of the Invention

Hereinafter, a preferred embodiment of the present invention will be described with reference to the accompanying drawings. In the drawings, the same element, although depicted in different drawings, will be designated by the same reference numeral or character. Also, in the

following description of the present invention, a detailed description of known functions and configurations incorporated herein will be omitted when it may make the subject matter of the present invention rather unclear.

FIG. 1 is a block diagram sketching a monitoring system 100 for monitoring location determination performance of an A-GPS method in accordance with the preferred embodiment of the present invention.

The monitoring system 100 in accordance with the present invention includes a mobile communication terminal 110, a test device 120, a radio base station 130, a mobile switching center 140, a STP 150, a LBS system 160 and a LBS platform 170.

The mobile communication terminal 110 which is equipped with a GPS antenna, a GPS receiver, a GPS chip set, etc., to thereby pick up GPS radio wave broadcast from orbiting GPS satellites(not shown), extracts navigation data from the GPS radio wave and transmits the navigation data to the LBS system 160.

The mobile communication terminal 110 can be a PDA(Personal digital Assistant), a cellular phone, a PCS(Personal Communication Service) phone, a hand-held PC, a

GSM(Global System for Mobile) phone, a W-CDMA phone, an EV-DO phone, a MBS(Mobile Broadband System) phone, a WLL(Wireless Local Loop) phone and a digital TRS(Trunked Radio System) phone. Herein, the MBS phone refers to a mobile phone which will be used in fourth-generation communication systems.

The test device 120 procures various parameters defined in the IS-801-1 standard in relation to the position fix from the mobile communication terminal 110 through wired and/or radio link, analyzes and processes the parameters, and display the result of the analysis and the process. Herein, the radio communication refers to, but not limited to, an infra-red communication, a bluetooth communication or a RF(Radio Frequency) communication. The test device 120 is loaded with a built-in LBS wireless network analysis program for performing analysis on the performance of the position determination and providing display of analysis results by using the parameters defined the IS-801-1 standard in accordance with the present invention.

The LBS wireless network analysis program in accordance with the present invention procures the LBS messages defined in the IS-801-1 standard which the mobile

communication terminal 110 collects from a position determination server 162, performs analysis on the LBS messages and displays analysis results. In addition, the LBS wireless network analysis program displays information on the wireless network to which the mobile communication terminal 110 is being currently connected, a pseudo random noise code of a radio base station which gathers and transmits the LBS messages from the position determination server 162 and the strength of the pseudo random noise code.

The mobile communication network in accordance with the present invention can be a CDMA(Code Division multiple Access), GSM(Global system for Mobile communication), CDMA2000 1X, 3X, EV-DO, EV-DV, WCDMA(Wideband CDMA), PI(Portable Internet), WLL(Wireless Local Loop) and Digital TRS(Trunked Radio System).

The radio base station 130, housed with a BTS(Base station Transceiver System) 132 and a BSC(Base Station Controller) 134, performs functions such as processing call request from the mobile communication terminal 110 and relaying the parameter messages defined IS-801-1 standard communicated between the mobile communication terminal 110 and the LBS system 160.

The base station transceiver system 132 is a network endpoint equipment generally performing a base band signal processing, wired/radio conversion, transmission and reception of wireless signal, and especially in the preferred embodiment, performs communication with the test device 120 via the mobile communication terminal 110.

The base station controller 134 which performs comprehensive control over the base station transceiver system 132 performs various functions such as a radio channel allocation and release with respect to the mobile communication terminal 110, transmission power control of the test device 120 and the base station transceiver system 132, decision of soft handoff or hard handoff, transcoding and vocoding, GPS clock distribution, operation and maintenance of the base station transceiver system 132.

The mobile switching center 140 controls the radio base station to more effectively operate and communicate with an electronic switching system installed in a public telephone network. The mobile switching center 140 receives data or messages from the mobile communication terminal 110 through the radio base station 130 and transfers the received data or messages to the position determination

server 162.

The signal transfer point (STP) 150 is a signal relay station for relaying and exchanging signal messages in a common channel signaling system of ITU-T. A signal network formed using the STP 150 operates in a non-associated mode which does not associate a speech path with a signal path. Various signals are transferred via the STP 150 having a speech path, other than a switching center, thereby improving reliability and cost-effectiveness. Also, the STP 150 converts a signal message. When it is not possible to relay a signal message, the STP 150 notifies the signal message to another switching center.

The LBS system 160 includes a position determination server 162 and a MPC(Mobile Positioning Center) 164. The position determination server 162 calculates longitude and latitude coordinate values by using the navigation data received from the mobile communication terminal 110 through the wireless network. Further, the position determination server 162 transmits an aiding data for use in the position determination of the mobile communication terminal 110 and calculates distance between the GPS satellite and the mobile communication terminal 110. Herein, the aiding data is

transmitted according to the TCP/IP protocol.

The mobile positioning center 164 obtains the longitude and latitude coordinate values of the mobile communication terminal 110 calculated at the position determination server 162 and transmits the coordinate values to the LBS platforms 170 that provides various location based services.

The LBS platform 170 comprehensively refers to an application server for providing the location based services for the mobile communication terminal 110. The LBS platform 170 obtains the longitude and latitude coordinate values of the mobile communication terminal 110, performs coordinate conversion and the like, and finally provides the location based services. The data exchange between the position determination server 162 or the position center 164 and the LBS platform 170 is executed based on the TCP/IP protocol.

FIG. 2 shows the LBS messages communicated between the mobile communication terminal 110 and the position determination server 162.

Referring to the exemplary screen of FIG. 2, a transmission time, message type and message name of the LBS message defined in the IS-801-1 standard are displayed.

These messages transmitted and received between the mobile communication terminal 110 and the position determination server 162 and displayed on a real time basis on the screen of the test device 120. The user can easily rearrange the messages according to time and type of the messages and monitor rearranged messages displayed on the test device 120.

Kinds of messages analyzed and displayed by the LBS wireless network analysis program in accordance with the present invention are, as shown in FIG. 2, "Request MS Information", "Request Pilot Phase Measurement", "Provide MS Information", "Provide Pilot Phase Measurement", "Request Pseudorange Measurement", "Provide Pseudorange Measurement", "Provide GPS Acquisition Assistance", "Provide GPS Sensitivity Assistance", "Request Location response", etc.

The LBS wireless network analysis program classifies the LBS messages as forward channel messages versus reverse channel messages and distinctively displays the classified LBS messages, wherein the forward channel messages refer to LBS messages transmitted from the position determination server 162 toward the mobile communication terminal 110 whereas the reverse channel messages refer to LBS messages transmitted from the mobile communication terminal 110

toward the position determination server 162. Also the LBS wireless network analysis program classifies the LBS messages according to time of transmission or reception or according to a message type, e.g., a request type(Req_Type) and a response type(Resp_Type) to display distinctively each classified messages.

Turning back to FIG. 2, detailed information on the "Provide MS Information" message which is highlighted on the third row of the left hand side of the screen is being displayed on the right hand side of the screen. On the right hand side of the screen, information on auxiliary data for use in the mobile communication terminal's reception of the GPS radio wave such as a GPS Acquisition Assistance, GPS Sensitivity Assistance, GPS Almanac, GPS Ephemeris, GPS Navigation Message Bits, GPS Almanac Correction and GPS Autonomous Acquisition Capable are being displayed.

Herein, the message "Provide MS Information" is well known from the IS-801-1 standard as such will not be discussed in great detail.

FIG. 3 gives an exemplary two dimensional constellation of a multiple satellites about the true position of the mobile communication terminal 110.

Description will now be given in conjunction with FIG. 1 and FIG. 3. The position determination server 162 transmits the "Provide GPS Acquisition Assistance" message defined in the IS-801-1 standard to the mobile communication terminal 110. The mobile communication terminal 110 transmits the "Provide GPS Acquisition Assistance" message to the test device 120 which is connected to the mobile communication terminal 110 through wired cable link. Consequently, the LBS wireless network analysis program extracts an azimuth angle and an elevation angle for each satellite contained in the "Provide GPS Acquisition Assistance" message. The LBS wireless network analysis program displays at least one GPS satellite which is visible from the true position of the mobile communication terminal 110 on the two dimensional plane by using extracted azimuth angle and the elevation angle.

Meanwhile, the LBS wireless network analysis program indicates with a certain color the information of the GPS satellite(identification number of the GPS satellite) which the position determination server 162 provides for the mobile communication terminal 110 and extracts information on the GPS satellite that the mobile communication terminal

110 perceived from the "Provide Pseudorange Measurement" message. Next, the LBS wireless network analysis program indicates the GPS satellite that the mobile communication terminal 110 perceived on the same screen but with a different color to thereby enable the user to acquire knowledge on which satellite the mobile communication terminal 110 perceives in true test environment.

Turning back to FIG. 3, around the concentric circles, there are indicated an identification number of the GPS satellite(PRN number) included in the "Provide GPS Acquisition" message that the mobile communication terminal 110 receives from the position determination server 162 as well as an identification number of the GPS satellite that the mobile communication terminal 110 actually gained acquisition by using the "Provide GPS Acquisition" message. Herein, the concentric circles are indicated by reference to the elevation angle, the outermost circle being 0 degree, next being 30 degrees, the next being 60 degrees and the center being 90 degrees.

In the concentric circles of FIG. 3, the identification numbers of the GPS satellites 8, 10, 15, 17, 23, 26 and 29 are information included in the "Provide GPS

Acquisition" message, whereas the identification numbers of the GPS satellites 6, 9, 18 and 24 are information that the mobile communication terminal 110 actually gained acquisition from the "Provide GPS Acquisition" message. The position determination performance is considered fine as the number of matching numbers between these two groups of identification numbers is large.

The LBS wireless network analysis program renders the screen to display a C/No(Carrier to Noise) or the strength of the GPS radio wave transmitted from each GPS satellite that the mobile communication terminal 110 actually gained acquisition along with the relevant identification number of the GPS satellite. Herein the C/No is a value presenting a reception sensitivity of the GPS radio wave broadcast from each GPS satellite. In other words, the C/No is a signal to noise ratio at 1 Hz bandwidth and is an important indicator in evaluation of capability of a GPS receiver. The larger the C/No value is the better the mobile communication terminal 110 receives GPS radio wave. The LBS wireless network analysis program, as shown in lower part of FIG. 3, displays the identification number of the GPs satellites and respective C/No values with a bar graph on the two

dimensional coordinate along with the numeric C/No values.

FIG. 4 is an exemplary screen displaying coordinate values of the mobile communication terminal 110 measured in accordance with the present invention about the concentric circles.

Describing in conjunction with FIG. 1 and FIG. 4, the position determination server 162 transmits the "Provide Location Response" message that includes longitude and latitude values of the mobile communication terminal 110. The "Provide Location Response" message arrived at the mobile communication terminal 110 consequently forwarded to the test device 120 through the wired cable link, and finally the LBS wireless network analysis program extracts the longitude and the latitude values included in the "Provide Location Response" message and renders the values as a point on the map. To display the map on the screen, the test device 120 is loaded with electronic map data.

Herein, the electronic map data stored in the test device 120 has been made in WGS(World Geodetic System)-84 format. The map can also display concentric circles centering at a specific location with an interval of e.g., 50 meters as well as 4 directional intersections. In

addition, the LBS wireless network analysis program is capable of zooming in or zooming out the map by the reference of the concentric circles or the 4 directional intersections and displaying the map zoomed in or zoomed out.

The LBS wireless network analysis program extracts the longitude and latitude values of the mobile communication terminal 110 contained in the "Provide Location Response" message which has been received from the position determination server 162 and displays the position of the mobile communication terminal on the map.

To be more specific, the LBS wireless network analysis program displays some area of the map around the coordinate values of the true position of the mobile communication terminal 110. Herein, the coordinate values of the true position can be determined as an average value of the measured positions(longitude and latitude values). At least one concentric circles having different radius each center of which is the coordinate values of the true position are displayed. For instance, the radius of the concentric circles may be 10 m, 20 m, 30 m, 50 m, 100 m, 150 m and the like.

Next, the LBS wireless network analysis program

extracts the longitude and latitude values from the "Provide Location Response" message received from the mobile communication terminal 110 and displays the longitude and latitude values on the map. In case the positions of the mobile communication terminal 110 are consecutively determined, the measured position values are sequentially indicated on the map. Therefore, the measured values consecutively measured are indicated in each concentric circle as shown in FIG. 4.

In the meantime, the LBS wireless network analysis program in accordance with the present invention supports both a fixed reference mode and a moving reference mode. The fixed reference mode refers to a map display method that the measured position is analyzed and indicated while the position of the mobile communication terminal 110 is fixed at a certain point, while the moving reference mode refers to another map display method that the measured position is analyzed and indicated while the position of the mobile communication terminal 110 is moving about on the map. In case of the moving reference mode, the real time measured position of the mobile communication terminal 110 are set to be always located at the center of the map so that the map

is made shifting according to the movement of the position of the mobile communication terminal 110.

The horizontal axis(x-axis) represents a measurement sequence and the vertical axis(y-axis) represents a position error between the true position and the measured position. The position errors associated with the measurement sequence are indicated as dots on a real time basis and each neighboring dot is consecutively connected with a line so that the trend of the distant errors may be easily read.

The LBS wireless network analysis program estimates and displays the number of total measurements; the number of measurements having position error whose radius is less than each of 10 m, 20 m, 30 m, 50 m, 100 m, 150 m, respectively; and/or the number of measurements having position error within up to 67% or 95% counting from the least position error among the total measured points. Referring to FIG. 4, it can be known that 67% of the measured points lie within the circle of radius 38.5 m and 95% of the measured points lie within the circle of radius 100.7 m, the center of each circle being the true position of the mobile communication terminal 110.

Certainly, the scale or range of the position errors

can vary. In addition to the above, the LBS wireless network analysis program is capable of calculating and displaying a so-called "bias east" or "bias north", wherein the bias east may be an average horizontal component of the position errors accumulated up to a certain time and the bias north may be an average vertical component of the position errors accumulated up to the certain time.

Meanwhile, the LBS wireless network analysis program in accordance with the present invention can be stored in a computer-readable storage medium, wherein the storage medium can be any one out of a floppy disc, a hard disc, a ZIP disc, a JAZ disc, a compact disc, a DVD(Digital Versatile Disc).

Although a preferred embodiment of the present invention has been described for illustrative purposes, those skilled in the art will appreciate that various modifications, additions and substitutions are possible, without departing from the scope and spirit of the invention as disclosed in the accompanying claims.

Industrial Applicability

As described above, evaluation of the position determination performance can be promptly and effectively

performed by using the method and system in accordance with the present invention.

In addition, the wireless network operator can provide higher quality location based services to the users since the method and system in accordance with the present invention provide prompt identification of the reasons for failure of the position determination when the position determination suffers.

What is claimed:

1. A system for monitoring performance of a position determination of a mobile communication terminal by using a wireless network and an A(Assisted)-GPS, the system comprising:

the mobile communication terminal equipped with a GPS module for picking up GPS radio wave containing a navigation data from a GPS satellite and transmitting the navigation data to the wireless network;

a test device, connected to the mobile communication terminal through wired/radio link, for being loaded with and running a LBS wireless network analysis program, wherein the LBS wireless network analysis program gathers, analyzes and processes data pertinent to the position determination and classifies processed data by at least one classification reference and displays classified data in the format of text or graph; and

a position determination server for receiving the navigation data from the wireless network, converting the navigation data into longitude and latitude coordinate

values, transmitting the longitude and latitude coordinate values to the mobile communication terminal and performs transmission and reception of the data pertinent to the position determination.

2. The system of claim 1, wherein the data pertinent to the position determination is a LBS message that the mobile communication terminal acquires from the position determination server, the LBS message being defined in the IS-801-1 standard.

3. The system of claim 2, wherein the LBS wireless network communication network analyzes the LBS message and consequently indicates the time information of transmission or reception of the LBS message, the name of the LBS message, and a type of message, wherein the type of message is whether the LBS message is a forward channel message, a reverse channel message, a request message or a response message.

4. The system of claim 3, wherein the name of the LBS message is one of "Request MS Information", "Request Pilot Phase Measurement", "Provide MS Information", "Provide Pilot Phase Measurement", "Request Pseudorange Measurement", "Provide Pseudorange Measurement", "Provide GPS Acquisition Assistance", "Provide GPS Sensitivity Assistance", "Request Location response".

5. The system of claim 1 or 2, wherein the LBS wireless network analysis program analyzes and displays information on the GPS satellite, wherein the information on the GPS satellites is more than one out of an azimuth angle, an elevation angle, a total number of the GPS satellites and an identification number of each satellite included in a "Provide GPS Acquisition" message.

6. The system of claim 1 or 2, wherein the LBS wireless communication analysis program analyzes and displays information on the GPS satellite, wherein the information on the GPS satellite is more than one out of a total number of the GPS satellites and an identification

number of each satellite included in a "Provide Pseudorange Measurement" message.

7. The system of claim 2, wherein the LBS wireless communication analysis program extracts and displays information on the wireless network, a pseudo random noise code of a radio base station which transmits the LBS message and strength of the pseudo random noise code, from the LBS message.

8. The system of claim 7, wherein the wireless network is one out of a CDMA(Code Division multiple Access), GSM(Global system for Mobile communication), CDMA2000 1X, 3X, EV-DO, EV-DV, WCDMA(Wideband CDMA) and PI(Portable Internet).

9. The system of claim 1, wherein the mobile communication terminal communicates with the test device through an infra-red communication link, Bluetooth communication link or a radio frequency link.

10. The system of claim 1, wherein the mobile communication terminal exchanges the data pertinent to the position determination with the position determination server through a TCP/IP(Transmission Control Protocol/Internet Protocol) link.

11. The system of claim 1, wherein the mobile communication terminal is one out of a PDA, a cellular phone, a PCS(Personal Communication Service) phone, a hand-held PC, a GSM(Global System for Mobile) phone, a W-CDMA phone, an EV-DO phone and a MBS(Mobile Broadband System) phone.

12. A method for monitoring performance of position determination of a mobile communication terminal in a communication system including a mobile communication terminal picking up GPS radio wave and receiving LBS messages, a test device communicating with the mobile communication terminal and a position determination server performs transmission and reception of the LBS messages, the method comprising the steps of:

(a) receiving the LBS messages on a real time basis from the mobile communication terminal;

(b) analyzing received LBS messages on a real time basis; and

(c) processing analyzed LBS messages into a requested format and displaying converted LBS messages in the format of text or graph.

13. The method of claim 12, wherein the LBS messages are messages defined in IS-801-1 standard.

14. The method of claim 12, wherein at step (a), the test device acquires the LBS messages from the mobile communication terminal through wired and/or radio link.

15. The method of claim 12, wherein the receiving, analyzing, processing and displaying are preformed by a LBS wireless network analysis program loaded in the test device.

16. A computer readable storage medium storing a LBS(Location Based Service) wireless network analysis program receiving, analyzing, processing and displaying LBS messages defined in IP-801-1 standard by using a wireless network and an A(Assisted)-GPS(Global Positioning System),

wherein the LBS wireless network analysis program, coded in a computer language, performs analyzing the LBS messages, displays analyzed LBS messages, and processes and displays information on the wireless network, information on GPS satellite and measured coordinate values included in the LBS messages in text and/or image format.

17. The computer readable storage medium of claim 17, wherein the LBS wireless network analysis program displays the time information of transmission or reception of the LBS message, the name of the LBS message, and a type of message, wherein the type of message is whether the LBS message is a forward channel message, a reverse channel message, a request message or a response message.

18. The storage medium of claim 17, wherein the name of the LBS message is one of "Request MS Information", "Request Pilot Phase Measurement", "Provide MS Information", "Provide Pilot Phase Measurement", "Request Pseudorange Measurement", "Provide Pseudorange Measurement", "Provide GPS Acquisition Assistance", "Provide GPS Sensitivity Assistance", "Request Location response".

19. The storage medium of claim 17, the information on the wireless network is at least one out of a kind of the wireless network processing the LBS messages, a pseudo random noise code of a radio base station and strength of the pseudo random noise code.

20. The storage medium of claim 19, wherein the wireless network is at least one out of a CDMA(Code Division multiple Access), GSM(Global system for Mobile communication), CDMA2000 1X, 3X, EV-DO, EV-DV, WCDMA(Wideband CDMA) and PI(Portable Internet).

21. The storage medium of claim 19, wherein the information on the GPS satellite is more than one out of an azimuth angle, an elevation angle, a total number of the GPS satellites and an identification number of each satellite, included in a "Provide GPS Acquisition Assistance" message.

22. The storage medium of claim 16, wherein the information on GPS satellite is at least one out of a total number of the GPS satellites and an identification number of each satellite.

23. The storage medium of claim 21 or 22, wherein each of the information on GPS satellite is distinctively indicated with different color, text or pattern on a screen displaying more than one concentric circles and 4 directional intersections, the concentric circles consecutively indicating angles ranging from 0 degree to 90 degrees.

24. The storage medium of claim 18, wherein the LBS wireless network analysis program displays the identification number of each satellite and C/No(Carrier to Noise) on a planar coordinates, both being included in the "Provide Pseudorange Measurement" message, wherein the C/No represents a reception sensitivity of the GPS radio wave.

25. The storage medium of claim 16, wherein the LBS wireless network analysis program stores therein a map data and displays the measured coordinate values as a point as well as a map around the point.

26. The storage medium of claim 25, wherein the map data is made in the format of WGS(World Geodetic System)-84.

27. The storage medium of claim 25, wherein the LBS wireless network analysis program is capable of zooming in or zooming out the map with the reference of the concentric circles or the 4 directional intersections and displaying the map zoomed in or zoomed out.

28. The storage medium of claim 25, wherein the LBS wireless network analysis program supports both a fixed reference mode and a moving reference mode, wherein the fixed reference mode refers to a map display method that the measured position is indicated while the position of a mobile communication terminal is fixed at a certain point, while the moving reference mode refers to another map display method that the measured position is indicated while the position of the mobile communication terminal is moving about on the map.

29. The storage medium of claim 16, wherein the LBS wireless network analysis program displays a position error sequentially on a real time basis, the position error representing a difference between the measured coordinate values and a true position.

30. The storage medium of claim 29, wherein a scale of the position error is adjustable.

31. The storage medium of claim 29, wherein the LBS wireless network analysis program assesses and displays the number of total measurements; the number of measurements having position error within a prescribed range of radius when counting from the least position error among the total measured points.

32. The storage medium of claim 31, wherein the LBS wireless network analysis program is capable of calculating and displaying a "bias east" or "bias north", wherein the bias east can be an average horizontal component of the position errors and the bias north may be an average vertical component of the position errors.

33. The storage medium of claim 16, wherein the storage medium is one out of a floppy disc, a hard disc, a ZIP disc, a JAZ disc, a compact disc and a DVD(Digital Versatile Disc).

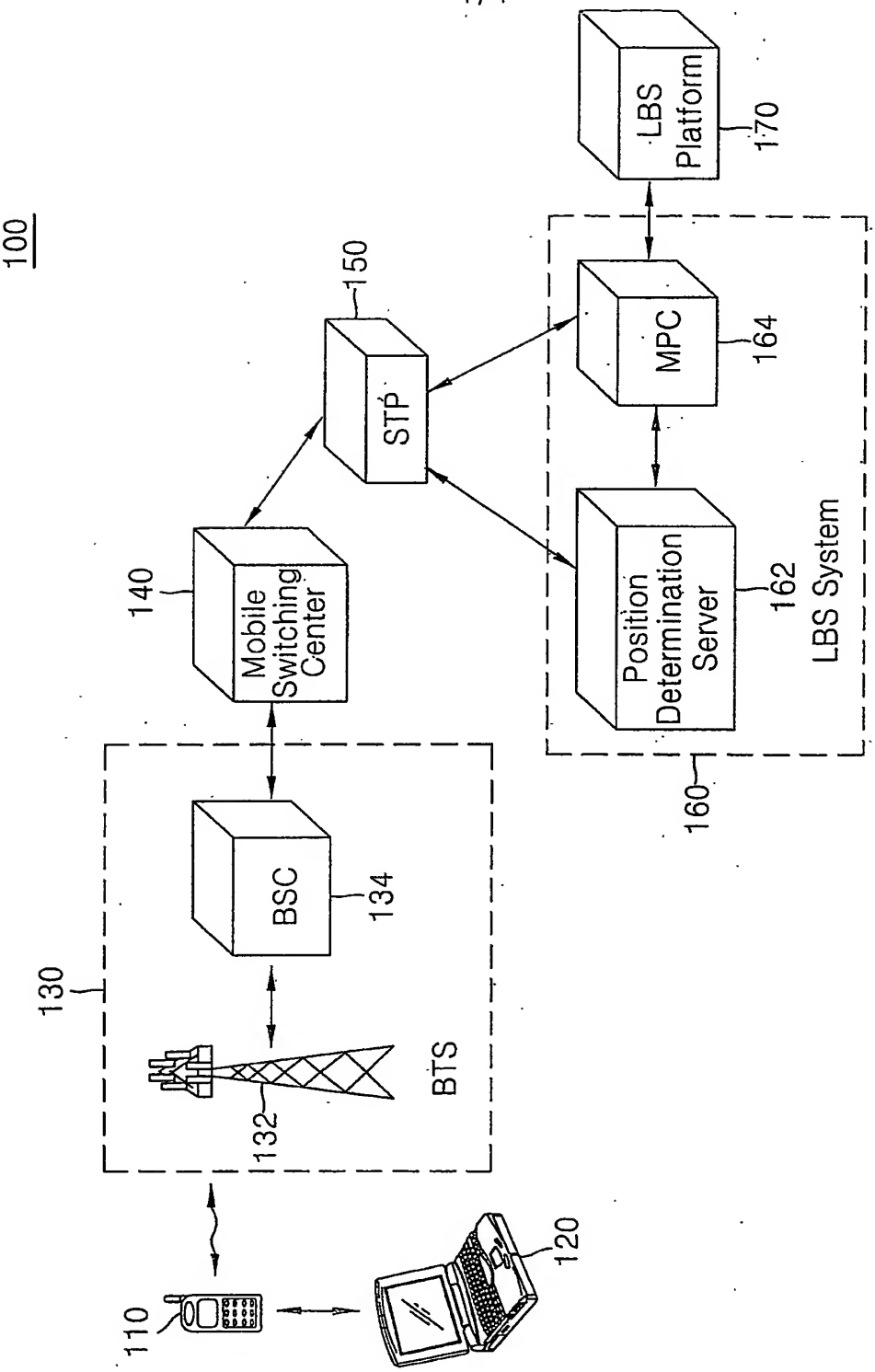
100
LBS Platform
170
150
STP
MPC
164
140
Mobile Switching Center
Position Determination Server
162
LBS System
160
130
BSC
134
BTS
132
120
110

FIG. 1

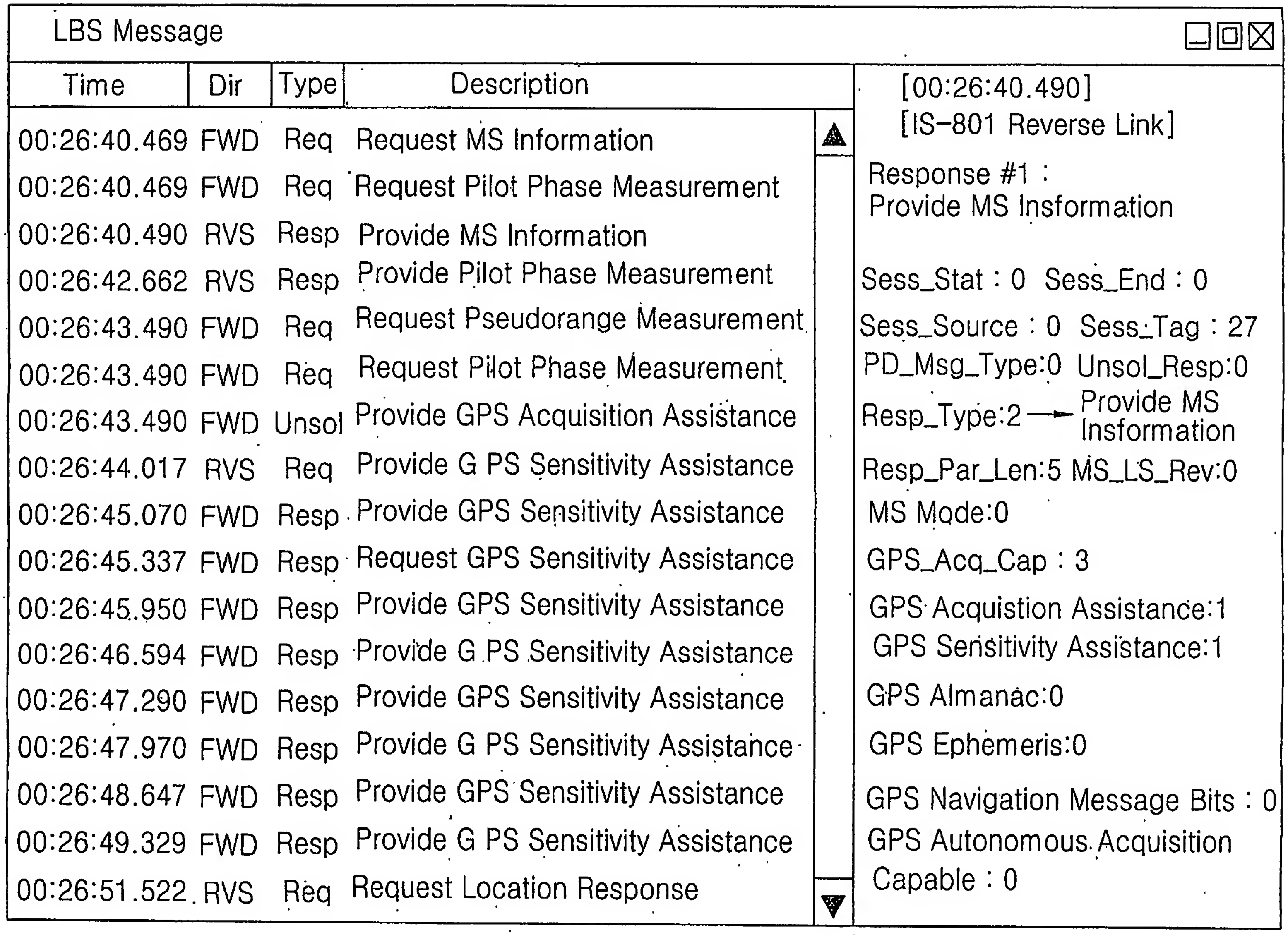
LBS Message
Time
Dir
Type
Description
00:26:40.469 FWD Req Request MS Information
00:26:40.469 FWD Req Request Pilot Phase Measurement
00:26:40.490 RVS Resp Provide MS Information
00:26:42.662 RVS Resp Provide Pilot Phase Measurement
00:26:43.490 FWD Req Request Pseudorange Measurement
00:26:43.490 FWD Req Request Pilot Phase Measurement
00:26:43.490 FWD Unsol Provide GPS Acquisition Assistance
00:26:44.017 RVS Req Provide G PS Sensitivity Assistance
00:26:45.070 FWD Resp Provide GPS Sensitivity Assistance
00:26:45.337 FWD Resp Request GPS Sensitivity Assistance
00:26:45.950 FWD Resp Provide GPS Sensitivity Assistance
00:26:46.594 FWD Resp Provide G PS Sensitivity Assistance
00:26:47.290 FWD Resp Provide GPS Sensitivity Assistance
00:26:47.970 FWD Resp Provide G PS Sensitivity Assistance
00:26:48.647 FWD Resp Provide GPS Sensitivity Assistance
00:26:49.329 FWD Resp Provide G PS Sensitivity Assistance
00:26:51.522 RVS Req Request Location Response
[00:26:40.490]
[IS-801 Reverse Link]
Response #1 :
Provide MS Insformation
Sess_Stat : 0 Sess_End : 0
Sess_Source : 0 Sess_Tag : 27
PD_Msg_Type:0 Unsol_Resp:0
Resp_Type:2
Provide MS Insformation
Resp_Par_Len:5 MS_LS_Rev:0
MS Mode:0
GPS_Acq_Cap : 3
GPS Acquistion Assistance:1
GPS Sensitivity Assistance:1
GPS Almanac:0
GPS Ephemeris:0
GPS Navigation Message Bits : 0
GPS Autonomous Acquisition
Capable : 0

FIG. 2

Time	Type	Num	PRN	Azimuth	Elevation	C/No
13:49:37.819	PRM	9	29			36
13:49:37.819			23			36
13:49:37.819			10			40
13:49:37.819			17			32
13:49:37.819			15			30
13:49:37.819			8			33
13:49:37.819			24			37
13:49:37.819			18			
13:49:37.892	AA	11	26	303.8	78.8	
13:49:37.892			29	348.8	67.5	
13:49:37.892			23	337.5	56.3	
13:49:37.892			10	67.5	45.0	
13:49:37.892			17	303.8	33.8	
13:49:37.892			15	315.0	22.5	
13:49:37.892			8	45.0	11.3	
13:49:37.892			6	247.5	11.3	
13:49:37.892			24	146.3	11.3	
13:49:37.892			9	180.0	11.3	
13:49:37.892			18	281.3	11.3	
13:49:38.210	PRM	7	26			27
13:49:38.210			29			27
13:49:38.210			23			29

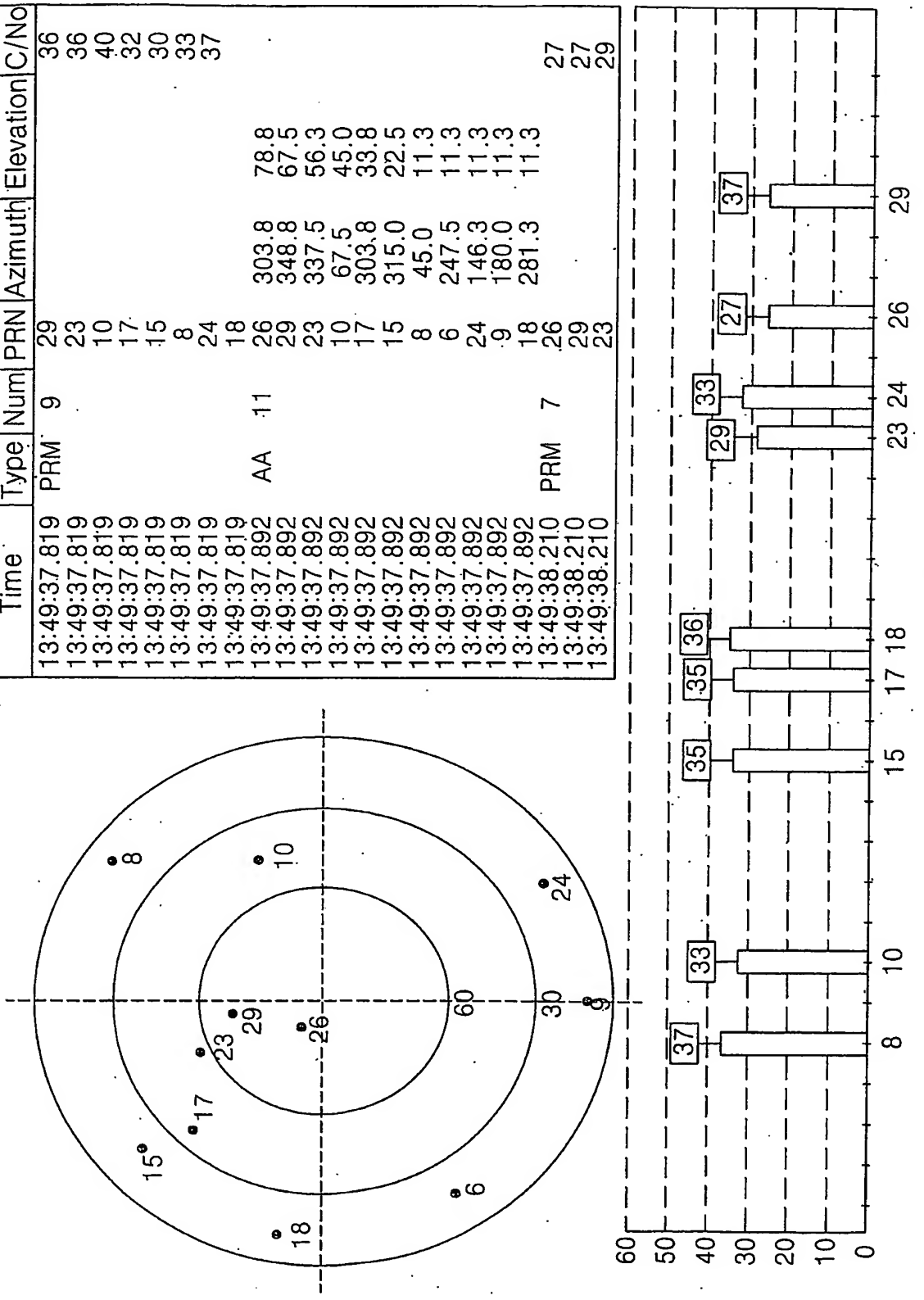

FIG. 3

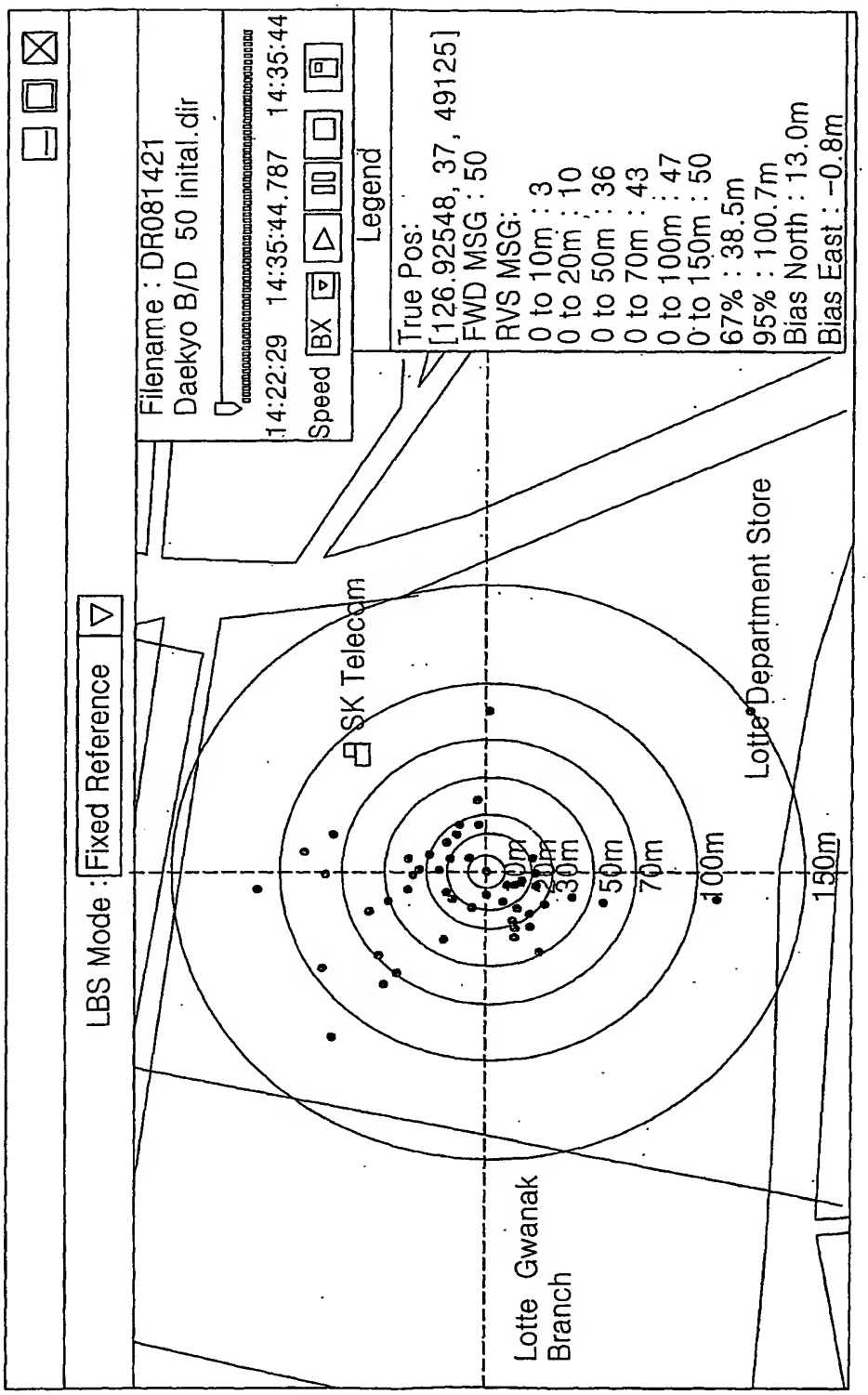
LBS Mode : Fixed Reference
Filename : DR081421
Daekyo B/D 50 inital.dir
14:22:29 14:35:44.787 14:35:44
Speed BX
Legend
True Pos:
[126.92548, 37, 49125]
FWD MSG : 50
RVS MSG:
0 to 10m : 3
0 to 20m : 10
0 to 50m : 36
0 to 70m : 43
0 to 100m : 47
0 to 150m : 50
67% : 38.5m
95% : 100.7m
Bias North : 13.0m
Bias East : -0.8m
SK Telecom
Lotte Department Store
Lotte Gwanak Branch
10m
20m
30m
50m
70m
100m
150m

FIG. 4